Geophysical Research Abstracts
Vol. 14, EGU2012-3506, 2012
EGU General Assembly 2012

Increasing diurnal and seasonal amplitudes in carbon and water fluxes after conversion from arable to grassland

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Land-use change is a topical scientific and political issue due to its potential to affect atmospheric greenhouse gas concentrations. Conversion of arable land to permanent grassland has been proposed as a strategy to sequester atmospheric CO_2 into soil organic matter. In this context, eddy covariance measurements were recorded over grazed grassland at a site in the temperate region of southern Germany (annual precipitation 775 mm, annual temperature 9°C) from 2002 to 2008. The site had been arable farm land for decades but from 2000 it became grassland grazed by cattle (Bos taurus). Over the study period the total ecosystem respiration (TER), gross primary production (GPP) and evapotranspiration (ET) increased during the growing season and, therefore, in annual totals (by about 80%, 85%, and 33%, respectively, during seven-year period). A similar trend could not be found for net ecosystem exchange (NEE) of carbon in the daily to annual sums, but was evident in the separated day and night fluxes of NEE. There was no trend in the meteorological conditions (temperature, precipitation) causing the trends. The main effect of the land use change was not a change in C sequestration but an increase in temperature sensitivity; in grassland the C distribution within the soil is closer to the surface than in arable systems, which causes the daily and yearly variations in C balance to increase.